

REMARKS

The above-identified patent application has been amended and Applicants respectfully request the Examiner to reconsider and again examine the claims as amended.

Claims 1-23 are pending in the application. Claims 1-23 are rejected. Claims are 1, 10-13, 15, 17, 22, and 23 are amended herein. Claims 2 and 14 are cancelled herein without prejudice.

As an initial matter, Applicants make note that the Examiner did not indicate approval of formal drawings earlier submitted on October 4, 2000. Instead, with the Office Action, the Examiner has included a Notice of Draftsperson's Drawing review pertaining to informal drawings dated June 14, 2000, indicating various objections. Applicants respectfully request approval of the formal drawings submitted on October 4, 2000.

The Rejections Under 35 U.S.C. §103(a)

The Examiner rejects Claims 1-11 and 17-23 under 35 U.S.C. §103(a) as being unpatentable over Wuyts (EP patent number 0772381 A1) in view of Wasserman.

Claims 1 is amended herein to incorporate the subject matter of Claim 2. Amended Claim 1 requires imaging by "...at least one of the plurality of cameras in first and second ones of the plurality of lighting modes in a single pass." Claims 17 and 23 are amended in a similar manner.

Applicants submit that amended Claims 1, 17, and 23 are patentably distinct over Wuyts, whether taken alone or in combination with Wasserman, since the cited references neither describe nor suggest imaging by "...at least one of the plurality of cameras in first and second ones of the plurality of lighting modes in a single pass," as set forth in Claims 1, 17, and 23.

With this particular arrangement, the present invention provides an inspection system in which data associated with more than one lighting mode can be captured in a single pass over a field of view. The inspection system does not have to return to the field of view in a second pass to capture data associated with another lighting mode.

Describing original Claim 23, the Examiner recognizes that "Wuyts does not specifically disclose... second and third ones of the plurality of lighting modes..." as recited in original Claim 23. Therefore, with regard to amended Claims 1, 17, and 23, Applicants submit that Wuyts does not describe or suggest the claimed plurality of lighting modes in a single pass.

Applicants submit that Wasserman fails to overcome the above deficiencies in Wuyts. In describing a conventional inspection system, Wasserman describes at column 4, lines 10-17, a 33.3 millisecond period associated with a camera transport rate of 15 inches per second. In relation to this period, Wasserman describes at column 4, lines 19-22 "[d]uring this time period, steps would be taken to acquire an image for storage and subsequent processing..." At column 4, lines 24-25, in contrasting the Wasserman inspection system to the conventional inspection system, Wasserman states "...the transport rate is doubled, to approximately 30 inches per second." Associated with the doubled rate, Wasserman states at column 4, lines 34-36 "...[r]esulting from this, the video cameras 13, 14, 15, 16 must now operate in opposing (odd/even) fields." Therefore, Applicants submit the Wasserman describes a system having a single lighting mode used to generate odd and even images at each pass over a particular region of the circuit board, in contrast to the claimed plurality of lighting modes in a single pass.

Applicants also respectfully direct the Examiner's attention to page 4, lines 8-16, where the Applicants have extensively discussed the Wasserman patent. For example, at page 4, lines 14-16, discussing Wasserman, it is described in the present specification that "[i]f there are three lighting modes for any camera, the camera head must visit the point three times, and so forth."

Furthermore, Applicants submit that there is no suggestion or motivation in the references to combine the reference teachings. Wuyts describes a circuit board assembly system.

As recognized by the Examiner, "Wuyts does not specifically disclose the use of plural cameras..." Also as recognized by the Examiner, "Wuyts does not specifically disclose... second and third ones of the plurality of lighting modes..." The Examiner relies upon Wasserman to provide those characteristics. However, by the Examiners own assertions, Wuyts does not contemplate the plurality of lighting modes that the Examiner attempts to combine. Therefore, Applicants submit that the Examiner has not met his burden to establish prima facie obviousness.

In view of the above, Applicants submit that Claims 1, 17, and 23 are patentably distinct over Wuyts, whether taken alone or in combination with Wasserman.

Claims 3-11 depend from and thus include the limitations of Claim 1, and Claims 18-22 depend from and thus include the limitations of Claim 17. Thus, Applicants submit that Claims 3-11 and 18-22 are patentably distinct over the cited references generally for the reasons discussed above in conjunction with Claims 1 and 17.

Applicants submit that Claim 7 is further patentably distinct over Wuyts, whether taken alone or in combination with Wasserman, since the cited references neither describe nor suggest "...a plurality of DMA channels for storing data in the memory, which is directly accessible by the main computer," as set forth in Claim 7.

DMA, or direct memory access, provided by some computer architectures, allows data to be sent directly from an attached device (for example a hard drive) to a main memory (e.g., RAM) used by a computer's central processing unit (CPU). In this way, the CPU is not involved with the data transfer, thus speeding up overall computer operation. The main memory retains not only the DMA data but also programs that execute in conjunction with the CPU, and which can directly operate on the DMA data.

With the particular arrangement of Claim 7, the present invention provides an inspection system for which optical data can be rapidly transferred by DMA to a main memory associated

with a computer CPU. For example, referring to FIG. 1, frame grabber units 122 can directly transfer data captured by the cameras 102a-102d to the memory 109 used by the main computer 108.

The Examiner recognizes that "...Wuyts does not disclose the plurality of channels are concurrently sent to the memory, where the memory data can be accessed directly by the main computer." Therefore, the Examiner recognizes that Wuyts does not describe or suggest DMA as claimed.

Applicants submit that Wasserman fails to overcome the above deficiencies in Wuyts. Referring to FIG. 2 of Wasserman, Wasserman describes at column 3, lines 55-64 "[t]he video outputs 21, 22, 23, 24 in turn communicate with a series of frame storage units 25, 26, 27, 28 which operate to receive and temporarily store the video signals for subsequent processing. To this end, the frame storage units 25, 26, 27, 28 communicate with central processing units 29, 30 via an information buss 31. Resulting from this, images acquired by the cameras 13, 14, 15, 16 and stored within the frame storage units 25, 26, 27, 28 can be selectively accessed and processed by the central processing units 29, 30, as desired."

Applicants submit that Wasserman describes a conventional arrangement having temporary storage of data in the frame storage units 25, 26, 27, 28, which is transferred to the central processing units 29, 30 for processing. Applicants therefore submit that, Wasserman does not describe or suggest the claimed optical inspection system having a plurality of DMA channels.

Applicants submit that Claim 8 is further patentably distinct over Wuyts, whether taken alone or in combination with Wasserman, since the cited references neither describe nor suggest "...a plurality of DMA channels for transmitting image data from at least two of the plurality of cameras to the memory, which is directly accessible by the main computer," as set forth in Claim 8.

Applicants submit that Claim 10 is further patentably distinct over Wuyts, whether taken alone or in combination with Wasserman, since the cited references neither describe nor suggest "... a velocity of the head assembly is adjustable to minimize inspection time of the object," as set forth in Claim 10.

Applicants submit that Claim 11 is further patentably distinct over Wuyts, whether taken alone or in combination with Wasserman, since the cited references neither describe nor suggest "... an event memory for storing firing position data, camera trigger data, and a lighting mode for each of the plurality of firing positions," as set forth in Claim 11.

Applicants submit that Claim 20 is further patentably distinct over Wuyts, whether taken alone or in combination with Wasserman, since the cited references neither describe nor suggest "... transmitting the image data over a plurality of DMA channels," as set forth in Claim 20.

Applicants submit that Claim 22 is further patentably distinct over Wuyts, whether taken alone or in combination with Wasserman, since the cited references neither describe nor suggest "... imaging the circuit board in one pass over each stripe of the board, wherein at least one location on the board is imaged in at least two different lighting modes," as set forth in Claim 22.

Accordingly, Applicants submit that the rejection of Claims 1-11 and 17-23 under 35 U.S.C. §103(a) should be removed.

The Rejections Under 35 U.S.C. §102(b)

The Examiner rejects Claims 12-16 under 35 U.S.C. §102(b) as being anticipated by Wasserman (US patent number 5,260,779).

Applicants have amended Claim 12 herein to require that "...each of the plurality of channels corresponds to a DMA channel." Support for this amendment can be found, for example, in original Claim 14, and at page 6, lines 24-26.

Applicants submit that Claim 12 is patentably distinct over Wasserman, since the cited reference neither describes nor suggests "...each of the plurality of channels corresponds to a DMA channel," as set forth in Claim 12.

For substantially the same reasons discussed above in conjunction with the rejection of Claim 1 under 35 U.S.C. §103(a), Applicants submit that Wasserman does not describe or suggest DMA channels as claimed. Applicants submit that Wasserman describes a conventional arrangement having temporary storage of data in the frame storage units 25, 26, 27, 28, which is transferred to the central processing units 29, 30 for processing. Applicants therefore submit that, Wasserman does not describe or suggest the claimed optical inspection system having a plurality of DMA channels.

In view of the above, Applicants submit that Claim 12 is patentably distinct over Wasserman.

Claims 13-16 depend from and thus include the limitations of Claim 12. Thus, Applicants submit that Claims 13-16 are patentably distinct over the cited reference generally for the reasons discussed above in conjunction with Claim 12.

For substantially the same reasons discussed above in conjunction with the rejections under 35 U.S.C. §103(a), Applicants submit that Claim 13 is further patentably distinct over Wasserman, since the cited reference neither describes nor suggests "...the optical inspection system is adapted to image a first location on the object with a first one of the plurality of cameras in first and second ones of the plurality of lighting modes in a single pass," as set forth in Claim 13. Also, Applicants again respectfully direct the Examiner's attention to page 4, lines 8-16, where the Wasserman patent is extensively discussed.

Accordingly, Applicants submit that the rejection of Claims 12-16 under 35 U.S.C. §102(b) should be removed.

In view of the above amendment and remarks, Applicants submit that Claims 1, 3-13, and 15-23 and the entire case are in condition for allowance and should be sent to issue and such action is respectfully requested.

The Examiner is respectfully invited to telephone the undersigning attorney if there are any questions regarding this Amendment or this application.

The Assistant Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 500845.

Respectfully submitted,

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Attachments: none

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